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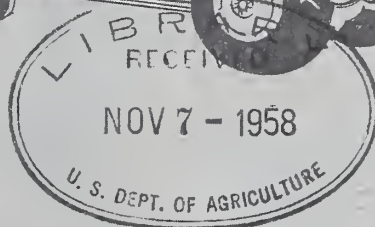
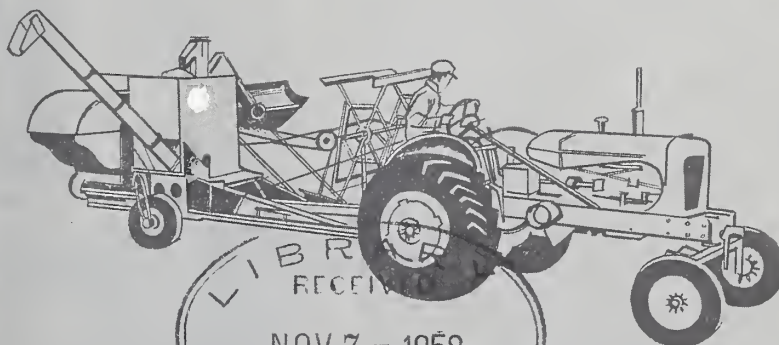
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CUT THE MACHINERY COSTS

**that
cut your
farm
profits**



What size???? All costs???? Investment???? New or used???? Which type??



Custom work???? Repair service handy???? Finish work, how soon???



Spend less???? Spend more?????

FEDERAL EXTENSION SERVICE
U. S. Department of Agriculture

WHAT THIS PUBLICATION IS ALL ABOUT...

Farming today is no longer just a way of life. It is also a business which has a greater investment in equipment per worker than is found in American industry. You are the owner, the manager, and the laborer. You have to make decisions, then act on and live with them. Ideas and methods are presented in this bulletin that can be used to arrive at sounder decisions with resulting lower costs or greater returns. Use them, they are yours.

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Cooperative Extension Work: United States Department of Agriculture and State Land-Grant Colleges and Universities Cooperating.

CUT THE MACHINERY COSTS THAT CUT YOUR PROFITS

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INTRODUCTION

Profitable farming today requires considerable machinery and equipment to make your labor most productive. On Kansas farms where records were kept for 1955, one-third of all farm expenses went for cash machinery costs and depreciation. Profitable farming today also requires a balance between the capital you invest and the labor you put into the farm business. It's never been more true that "You must spend money to make money."

But it is possible to spend money without adding to your income. At the same time many farmers can profitably spend more for machinery, especially if they can thus increase their volume of business and lower their costs per unit of product. The big questions are:

1. Which costs should I increase and which should I cut?
2. Which costs can I cut that will not cut my income even more?
3. Which machines are not essential to my farm business?

Many farmers are searching for ways to increase their income by cutting machinery costs, as well as using machinery more effectively. This pamphlet outlines some adjustments you might make.

Choosing the right type, size, and number of machines to operate your farm most efficiently is a difficult job. It is hard to know when a farm

is adequately equipped. Also, machinery is one of your biggest items of expense. So this part of the business offers one of your best opportunities to try to cut costs.

The percentage that machinery costs are of total farm costs varies with the kind of farm. On wheat and Corn Belt farms they are the biggest single expense item. A USDA study for 1955 showed that they ranged from 15 percent on sheep ranches in the southwest to 66 percent on grain and livestock farms in the northern Great Plains (Farm Cost Situation, Nov. 1956, USDA).

Machinery costs have been increasing as a result of continued specialization, substitution of machinery for labor, and higher prices. Since 1947-49 wholesale machinery prices have risen 26 percent. Part of this increase is due to more and better accessory equipment. Part is due to inflation.

Besides this trend toward more machinery, we also have a trend toward bigger machinery. About 80 percent of the wheel tractors now being shipped for farm use in the United States have a 30 horsepower belt rating or more. This is more than 3 times the 1947 volume when less than 25 percent had this rating (Farm Cost Situation, Nov. 1956, USDA).

Notice the rising costs of owning and operating machinery on Kansas farms. (1955 Farm Management Summary, Area No. 4, Extension Service, Kansas State College, Manhattan, Kans.)

From 1944 to 1955 machinery investment more than doubled on these farms, and the rate of depreciation also doubled. These increases are due to greater investment and a faster rate of depreciation. Of course, the size of farm and the size of business handled also expanded during these years. Depreciation and cash expenses on machinery accounted for 23 percent of all farm expenses in 1944 and 32 percent in 1955.

WHAT ARE MY MACHINERY COSTS?

The first step in cutting machinery costs is to recognize what the major costs are. We can call them (1) the cost of owning the machine, and (2) the cost of operating it. Then too, when you're comparing different machines, we have a third type of cost. We call them related costs. These are nonoperating costs associated with using the machine; we'll discuss them on pages 7 and 8.

Ownership Costs

For the most part ownership costs are fixed. Except for depreciation,

they are about the same whether you use the machine very little or a great deal. And most machines depreciate quite a bit as they become obsolete, even though you use them very little. Ownership costs are depreciation, taxes, insurance, interest on the investment, and housing costs. They usually amount to about 15 to 20 percent per year of the new cost of the machine.

Operating Costs

Three items belong in this class: (1) Repairs and maintenance, (2) lubrication, and (3) fuels.

Repairs and Maintenance.--This expense may be low during the early life of a machine. But as the machine grows older it will increase. Usually you can estimate your annual repair cost as a percentage of the new cost (table 1). For example, a tractor will use about 3.5 percent of its new cost each year in repairs. A \$3,000 tractor then would have an annual repair bill of \$105 (\$3,000 by .035). The \$105 is an average figure. If you are above average in the maintenance of your tractor, your repair bill is less. If you are below average, the repair bill is larger.

Lubrication.--These costs include greases and oils used to operate and

TRENDS IN MACHINERY INVESTMENT PER FARM, KANSAS - 1943-55

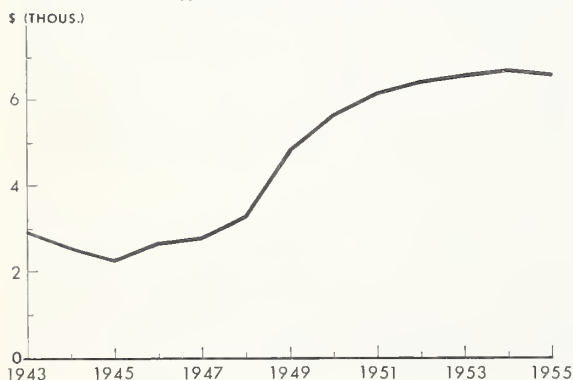


FIGURE 1.

TRENDS IN MACHINERY CASH EXPENSE AND DEPRECIATION PER FARM, KANSAS-1944-55

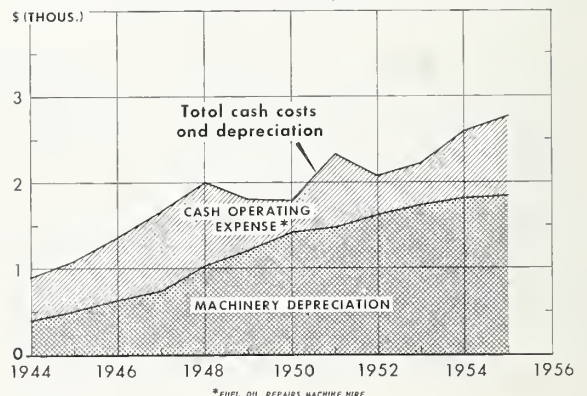


FIGURE 2.

* FUEL, OIL, REPAIRS, MACHINE HIRE

Table 1.--Suggested values to use in calculating annual repair, maintenance, and lubrication charges 1/

Machine	% of first cost of machine spent in annual repairs	Machine	% of first cost of machine spent in annual repairs
Baler, hay, with engine	3.8 <u>2/</u>	Lister	5.5
Binder	2.5	Loader, hay	1.5
Blower, forage	2.5	Manure spreader	2.0
Combine, trailed, P.T.O.	4.0	Mower	4.2
Combine, trailed, engine	3.5 <u>2/</u>	Planter, corn	2.5
Combine, self-propelled	3.4 <u>2/</u>	Plow, moldboard	7.4
Corn picker	4.0	Plow, vertical disk	5.5
Cultivator	3.8	Separator, cream	2.0
Cutter, ensilage	3.0	Sprayer, field	5.0
Disk, harrow	3.5	Rake, side delivery	2.5
Field, forage chopper	4.5	Rake, sweep	4.0
Grain drill	2.2	Tractor	3.5 <u>2/</u>
Grinder, burr	3.0	Truck	5.0 <u>2/</u>
Grinder, hammer	2.0	Wagon	1.5
Harrow, spike tooth	1.1	Weeder, rod	2.0

1/ Source: F. C. Fenton and G. E. Fairbanks, The Cost of Using Farm Machinery, Kansas Engineering Experiment Station Bulletin 74, 1954.

2/ Engine oil not included.

maintain your machinery. These costs are well spent. Many farm machines are used under the dustiest conditions possible. Proper lubrication is essential to good operation.

The oil used in an engine in a year's time should be about 3 percent of the fuel consumption.

Table 1 gives the amount of repairs, maintenance, and lubrication you can expect on farm machines under Kansas conditions. The costs on your farm may differ. You can adjust these research results as needed by keeping simple records of costs of some of your major machines. These costs should be mighty useful in guiding your machinery purchases.

Fuel.--Among these costs are gasoline, tractor fuel, diesel, or liquid petroleum gas used for your farm machinery.

University of Illinois studies indicate that a tractor used for both light and heavy farm jobs will have an hourly fuel consumption about 85 percent of that recorded under the rated drawbar load in the Nebraska tractor tests. If you know your actual average power requirement, you can figure the gasoline consumption at 8.5 horsepower-hours per gallon of fuel.

CUTTING MACHINERY COSTS

You can cut machinery costs by reducing operating costs or ownership costs. If, like most farmers, you are equipped and operating, your opportunity for immediate cuts may come in shaving your operating costs. How-

ever, in the long run your biggest single saving may be made by saving on ownership costs.

Cutting Ownership Costs

Cutting machinery costs may take a long-run plan. At any given moment many of your costs are somewhat fixed, since you frequently cannot dispose of the machines at a practical price even though a change appears wise. Machines also form functional groups; if you change one machine, you're often required to change others at the same time. Because of these complicating factors, the opportunity to cut some of these costs, particularly machinery investment and depreciation, may occur only when you're considering a new investment. Thus, your choices of which machinery to own are very critical.

Making wise choices of new machines and knowing when to trade are two important ways of cutting ownership costs directly. The number of hours a machine will be used is an important factor in buying machinery. Ownership costs may be cut indirectly by more hours of use.

Through More Use or Joint Investment.--Ownership costs form a large share of the total costs of a machine. You can spread these fixed costs by using the machine more hours--through custom work or enlarging your farm. More time at work means lower ownership costs per acre or per hour of use. Naturally this makes the machine more economical to own.

Of course, your decision to do custom work or expand farm size cannot rest solely on making effective use of machinery. The relative return from using labor and capital in these ways must be weighed along with lower machinery costs.

Owning expensive machines jointly with neighbors, or trading the use of machines, is another way to lower your investment for your work.

Cutting Operating Costs

Repairs and Maintenance.--United States' farmers in 1950 spent more than \$750 million on repair of farm machinery. This amounted to \$282 per year as the average farm repair bill for the tractor and other machinery.

You can cut your machinery repair costs. 4-H members in the tractor maintenance project have cut repair costs substantially. Their records prove it. They've done this by keeping machinery in good adjustment, using it as it is designed to be used, and doing good preventive maintenance. In other words, following the operators' manual.

You receive an operators' manual with every machine you purchase. USE IT. It is your guide to low-cost, longtime operation of your machine.

Breakdowns during the busy seasons can be very costly. Have your repair work done in the off season. Put your machine in A-1 condition before using it. Then, by proper maintenance and use of the machine, you can minimize these costly breakdowns.

You plant and harvest most crops with machinery. Much of your farm earnings come from crops, or from crops fed to livestock. You can materially raise your income by operating your machinery right. Understand each machine, how to use it, and how to get the most from it in quality and quantity of crops.

A good program of preventive maintenance is the key to a smaller repair bill.

Of course, one possible way to reduce repair costs is to do some or all of your own repair work. First, though, consider the costs and weigh them against possible savings: (1) The cost of acquiring the skill and knowledge, (2) the cost of the time used to do the work, and (3) the cost of the farm shop compared to the amount of work you have to do. After thinking through these points, some men may

decide to do much repair and others to do only simple upkeep.

Lubrication.--Usually your lubrication costs will go up somewhat when you follow a good preventive maintenance program. But you save these added costs many times over by lowering your repair bill. Be sure to store and use your lubricants in a safe, clean place. Dirty lubricants do more harm than good.

Fuels.--In 1954 farmers in all States spent just over \$1-1/3 billion for petroleum products for farm use. That's an average of \$418 per farm. You can cut this cost in three ways.

Engineers estimate that 10 percent of all petroleum fuel burned on the farm is wasted by faulty carburetor adjustment--an adjustment that you can make easily by following the operators' manual.

Another waste of power is operating machinery out of adjustment. Naturally this boosts fuel and operating costs. You may have seen plowing demonstrations where a plow was out of adjustment and the tractor would have to operate in second gear. When the plow was aligned properly the tractor could pull it easily in third gear. This would amount to a substantial saving in fuel used per acre.

Experts estimate that 75 percent of all farm machinery is operated out of proper adjustment. If that's true on your farm, you are using a lot more fuel than you need to and you are not getting the best performance the machine can give.

Storage of fuel is also important. University of Missouri tests show about a 3 percent loss of fuel from a red, unshaded storage tank. When the tank was painted white, shaded, and a pressure vent cap added, the evaporation loss was cut to a fraction of 1 percent. To cut evaporation losses the most, and to maintain quality of the fuel, underground storage is desirable.

In choosing the machines to purchase, you must decide which make, size, and type of equipment fits your needs the best. You must also decide whether it is better to own the machine or buy its services through custom work. Sometimes it will pay to delay buying a machine even though custom work is more expensive. The money may return more if used in some other way. All told, you need to consider the balance of machinery and labor to the total job to be done.

Your choice of a make or brand of machine to own is like automobile ownership--largely personal preference. Remember this one important factor though: The amount and kind of service that is available for the machine. If it breaks down you will want prompt, dependable, efficient service.

In any decision-making process involving farm machinery, the straight economic analysis of ownership and operating costs is often inadequate. Other factors enter in. These factors can be called related costs because they are associated with, or related to, the ownership and operation of the machine. While they are often intangible in the strict sense of cost, you must place a dollar value on them in order to arrive at a sound decision. Usually it is from these related costs that you make your decision.

What Are These Related Costs?

In choosing the type and size of machine, you must keep in mind not only the basic cost of different machines but these 5 other related costs and factors.

1. Costs of Associated Equipment.--Some machines require more companion equipment in order to use them. For example, in corn harvest-

ing, the picker-sheller requires more companion equipment than the corn-picker.

2. Diversity of Equipment.--Some items of equipment that go along with a machine may have many uses, while others may have but one use. You'll want to consider this when choosing which equipment to buy. For example, you can use a pickup hay chopper and its companion equipment to put up silage as well as make hay; but you can use a hay baler for only one job.

3. Time and Labor.--You can replace labor with machinery. For example, it takes less time to plow a field with a three-bottom tractor and plow, than with two-bottom equipment. Whether you want to make this substitution depends on the amount of capital and labor that you have and the other uses that you have for each. If plowing comes at a critical time on your farm, you may value your time highly enough to substitute machinery for your time. Machinery cost may be related to the amount of drudgery and hard work you wish to avoid, or the leisure that you wish to buy. You may select power steering for more convenient and easier work. Thus your decision of which machines to buy may not be based entirely on costs and expected accomplishments.

4. Quantity and Quality of Crop Produced.--The machine may have an effect on the yields. For example, a self-propelled combine harvests as well when opening up a field as later. A pull-type combine, on the other hand, may harvest only 75 percent of the standing grain on the opening swaths because of shattering as the tractor runs through the grain. Some machines are better fitted for doing the job than others and therefore harvest more of the crop.

Quality of crop produced is just as important as quantity in considering machinery. For example, a hay rake that shakes off much of the leaves

may cost less to own and operate than one that moves the hay gently across the swath, until you consider the additional leaves that are lost. Most of the feed value of hay is in the leaves, so it's important to save them. Therefore, we can afford to pay more for the rake that will give a higher quality product.

In other cases certain sets of equipment will produce both quantity and quality. For example, a drying installation will help you to get the largest production of a high quality crop. You can harvest the crop at a high moisture content, and thus cut the loss from shatter and the risk of weather. Drying maintains the quality.

5. Weather Risk.--A machine or set of machinery that lets you get the job done with minimum risk of weather may pay for itself in a single season. This may mean getting at the job sooner, as with a corn-picker-sheller-drying operation, or getting the job done faster with a larger size machine.

Because of these related costs and factors, many farmers prefer to use the returns per dollar spent, rather than the amount of their costs, as a guide to the machinery they can profitably own.

Example 1.--Choosing a Combine

In choosing a machine, you will have to figure the annual cost of owning each of several alternative machines. Let's take an example:

You have 180 acres of grain and want to know if you should buy a 6-foot pull-type combine or a 12-foot self-propelled.

First, set up a table similar to table 2 and work it through.

In this example it was cheaper to harvest the 180 acres of grain by owning a 6-foot pull-type combine than by owning a 12-foot self-propelled. The situation on other farms might

Table 2.—Annual Ownership and Operation Costs

	12-foot self- propelled	6-foot pull-type example
New cost	\$5,300	\$1,900
Ownership costs:		
Depreciation--new costs divided by 10 years <u>1/</u>	477	171
Interest--6 percent on one-half of new cost	159	57
Taxes-- $\frac{1}{2}$ to 1 percent of new cost; assume 1 percent	53	19
Insurance--0.25 percent of new cost	13	5
Shelter--0.75 percent of new cost	40	14
Total ownership costs	\$ 742	\$ 266
Operation costs:		
Repairs--self-propelled, 3.4 percent new cost	180	
--trailed, 3.5 percent new cost		67
Fuel, oil, and lubrication of combine; 1 gallon per acre on self-propelled	59	
$\frac{3}{4}$ gallon per acre on pull-type		40
Fuel, oil, and lubrication of tractor; about 1 gallon per acre		48
Total operation costs	\$ 239	\$ 155
Total ownership and operational costs	\$ 981	\$ 421
Associated factors:		
Associated equipment <u>2/</u>		
Tractor		120
Grain truck	---	---
Diversity of equipment <u>3/</u>	---	---
Convenience <u>4/</u>		50
Quantity of crop harvested <u>5/</u>		50
Quality of crop harvested <u>6/</u>	---	---
Time		
Labor--hours @ \$1/hour <u>7/</u>	50	90
Additional value of labor saved over \$1/hour	---	---
Weather risk <u>8/</u>	---	---
How and where the product will be used <u>9/</u>	---	---
Total consideration--owning and using	\$1,031	\$ 731

1/ A sale value of 10 percent of the original cost was assumed.

2/ The tractor is required in the pull-type combine, and the cost of ownership and repair is prorated. A grain truck is required with each machine; therefore, in comparing the two machines no charge is made.

3/ There is no diversity of equipment in this example.

4/ The operator estimated it was worth \$50 a year for the added convenience of operating the self-propelled combine. This \$50 could be taken off the self-propelled column, or, as in this case, added to the pull-type column.

5/ It was estimated the self-propelled combine would harvest about \$50 more grain because of opening the fields and taking a wider cut.

6/ No difference in quality.

7/ Under time, one has to consider not only the actual hours saved but the value of this labor. The labor may be used in other work or in an activity, such as a vacation, hunting, or fishing trip. In some cases, as in this example, no value will be placed on labor or time saved.

8/ Weather risk was not considered to be a factor in this example.

9/ How and where the product will be used has to be considered along with the machinery. Does the machine really fit the needs of the farm? In this case there was no difference between the two machines in this respect.

call for a different conclusion. If the 40 hours of time saved by doing the work with the self-propelled combine could be used to advantage, that machine could be the better method. When you consider only the ownership and operation costs, the comparison was more favorable to the smaller machine than when you consider the associated costs.

This same analysis method can be used to decide whether it is cheaper to own a machine or hire custom work done.

Maybe the associated factors in the combine example are of little or no importance in your decision. If so, you can work out a curve based on the cost per hour of use. Such a curve is quick and easy to use in estimating the cost of using a ma-

chine, as well as making comparisons with custom work. Naturally conditions vary from farm to farm so that the graphical method used in figure 3 serves only as a rough guide.

Example 2.--Choosing a Forage Harvester

With conditions as shown on the graph, if you use the harvester 100 hours annually, the cost will be about \$9 an hour. See (1) on graph. If the custom rate is \$11 an hour and you use the machine 100 hours, it is cheaper to own and operate your own machine. However, if you have only 60 hours of work a year for this harvester, then your decision to own and operate the machine or hire the work done depends on the availability of custom work. See (2) on graph.

COST PER HOUR OF USE OF FORAGE HARVESTER

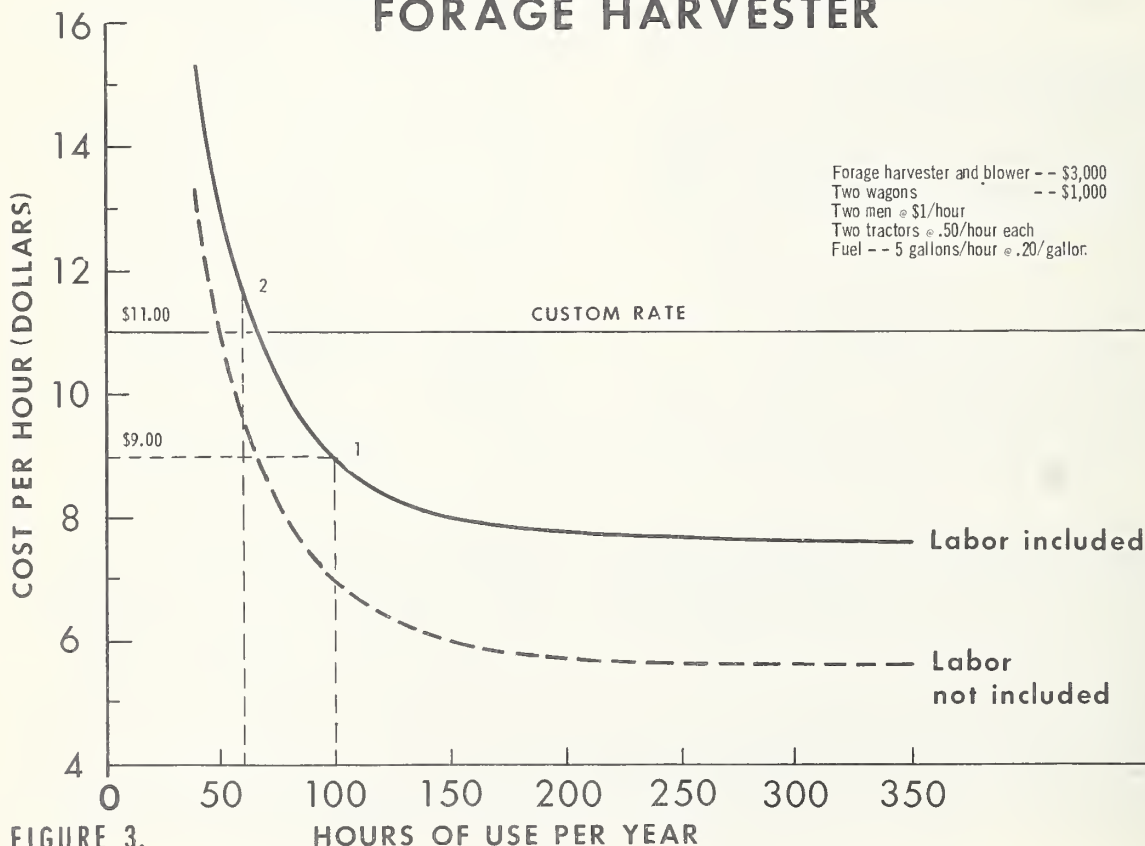


FIGURE 3.

These facts are based on costs given on the graph, including labor. Notice the dotted line, with no value for labor. The value you place on your labor during combining would change the location of the curve. Also, the point at which it would pay to consider custom work would vary.

In computing the number of days it will take to do a field, here's a rule of thumb: One-tenth the speed in miles per hour times the width of the machine in feet will equal the acres per hour you can cover with that machine.

Hiring Custom Work--Yes and No

Often when working through a partial budget to decide on size of machine to buy, you'll find it is cheaper to hire the work done by a custom operator. If so, you will have to answer "Yes" to these three questions, as well as consider the price, before you can decide fully on custom hiring:

1. Is custom work available?
2. Is it available when you need it?
3. Are the operators dependable and efficient?

Advantages of custom hiring you'll want to think through are:

1. You can avoid the investment in expensive machinery and use this capital elsewhere in your farm business where it may yield a higher return.
2. You may avoid the risk of obsolete machinery and machine damage by wind, fire, theft, or accident.
3. You can ease your labor problem if the custom operator furnishes the labor.
4. You may get a faster, more efficient job because the custom operator is usually more skilled than you in maintaining and operating his machinery.

Deciding When to Trade

No one can give "pat" answers to this problem, but here are some things to consider and a method of dealing with them.

It's hard to choose the best time to trade because it's hard to forecast what keeping the old machine will cost you. What will your repair bills be? How many breakdowns will occur? How serious may these breakdowns be in terms of lost time or crops? What will the trading situation be next year? Yet you must make some decision about these questions.

In extreme cases the decision is easy. Certainly, the risk of breakdown and the repair cost on a year-old machine would not be as high as the depreciation on a new machine. At the other extreme, with a 15-year old tractor these risks and impending costs may be so high that buying a new machine is a fairly easy decision. In between these two extremes lies a wide range of situations where your decision is difficult. Sometimes the pleasure of having a new machine is the basis for decision; sometimes the level of farm income is the deciding factor.

Usually, in deciding to trade, the economics of the situation is a starting point. To arrive at this, you have to place some rough evaluation on the costs of keeping the old machine compared with trading for a new one. Three kinds of considerations can be outlined. These are: (1) relative costs of ownership of the two machines, (2) relative costs of repairs and operation, and (3) the associated costs and considerations that go along with owning and using a given machine.

A fourth indirect cost must be distinguished in connection with the decision of when to trade. Older or poorly maintained machines may cause a greater risk of breakdown. This can be viewed as a cost of keeping the old

machine. In deciding what machinery to buy, you must assess this cost in the light of your particular situation. The costs and values placed on each of these will be different on each farm.

Arithmetic of When to Trade

To show how this might work, consider Tom Smith who has a two-bottom tractor 5 years old. He's considering whether to trade for a three-bottom diesel tractor. The best trade-in allowance he can find is \$500. At 5 percent interest this would mean the old tractor would cost him \$25 a year interest on his investment. He figures that the tractor will be worth \$100 less next year if he waits to trade. He could put the old tractor in shape for next year for \$300. Thus, his total cost would be \$425.

The new tractor that he is considering would cost \$3,000. At 5 percent the interest on this would amount to \$150 next year. He estimates that the first year depreciation will be

\$600. The basic cost so far would be \$425 on the old machine and \$750 on the new, or \$325 in favor of keeping the old machine.

But the new machine is more efficient in two ways. It takes less of Tom's time to perform field work and it operates more cheaply. He estimates that the value of time saved, savings on costs of operation, and increased timeliness of performing some jobs are easily worth \$200 per year. The pleasure of owning and working with a new machine, together with the increased dependability, is worth \$150. This \$350 is plus value or gain. The new machine also contains several conveniences, such as power steering and lights. It is difficult to value the pleasure of a new machine or conveniences that make work easier.

However, when you're deciding whether to pay out some of your hard-earned money for a new machine, you're forced to place some rough estimate on these, even though the economics of the situation is the starting point. In this case he would trade. In summary, it would look like this.

Next Year

<u>Old Tractor</u>		<u>New Tractor</u>	
Value \$500 @ 5 percent interest	-\$ 25	Value \$3,000 @ 5 percent	-\$150
Reduced trade-in value next year	- 100	Reduced trade-in next year	- 600
Repair to put it in shape	- 300	Total cost of new tractor	-\$750
		Efficiency	+\$200
		Less risk of breakdown <u>1/</u>	+ 100
		Pleasure of ownership and convenience of work	+ 50
		Total value of associated factors	+\$350
Total cost of old tractor	-\$425	Net cost of trading for a new tractor	-\$400

1/ The value of this smaller risk is estimated like an insurance premium. A serious breakdown, if it occurs, might cost \$300, but the chances of its occurring next year because the old tractor is used are estimated at only 1 in 3. Hence \$100 is credited to the new tractor.

COST CUTTING TIPS

Modern farming demands that a farm be well tooled. Money wisely spent on machinery is a good investment. But since machinery costs are major items of expense, it is possible to increase net income materially by making investments only after adequate study and proper maintenance of machinery.

Cutting Ownership Costs

Choose the best size and type of machine for the job.
Figure out the costs of owning and using different sizes and types of machinery.
Compare the quantity and quality of work with prices of alternative machines.
Reduce your investment perhaps by joint ownership of some machines.
Meet your needs sometimes with secondhand machinery.
Help solve your problem perhaps through custom work or custom hiring.
Figure through the economics of a trade before you make it.
Shop around for the best deal.

Cutting Operating Costs

Lower your repair bill by proper maintenance.
Extend useful life through preventive maintenance and timely repair.
Lubricate regularly. If you cut on lubrication costs, repair bills and breakdown losses will cost much more than your small "saving"
Check to see if you can take advantage of quantity discounts.
Get repair work done in off seasons.
Keep the machine adjusted.
Follow the operators' manual.

**Be Safe - - Money Can't Buy Life or Limbs.
This Cost Can't Be Cut.**

